

WE CLAIM

1. A telecommunications network having a mobile
phone, **characterized in that**

the mobile phone comprises an audio-modulated
5 vibrotactile module that responds to a telecommunications
signal containing information about incoming speech from
a called/calling party, for providing an audio-modulated
vibrotactile module force containing information about
the incoming speech from the called/calling party to
10 vibrate a user's fingers, facial skin, wrist, cheek or
other suitable location.

2. A telecommunications network according to claim
1, **characterized in that**

the audio-modulated vibrotactile module comprises an
15 audio-to-vibrotactile converter that responds to the
telecommunications signal, for providing an audio-to-
vibrotactile converter signal containing information
about a vibration modulation of the incoming speech from
the called/calling party.

3. A telecommunications network according to claim
2, **characterized in that**

the audio-modulated vibrotactile module comprises a
vibrotactile actuator that responds to the audio-to-
5 vibrotactile converter signal, for providing the audio-
modulated vibrotactile module force in the form of a
vibrotactile actuator force.

4. A telecommunications network according to claim
1, **characterized in that**

10 the telecommunications system comprises an audio-to-
vibrotactile converter that responds to an incoming audio
signal containing the incoming speech from the
called/calling party, for providing the
telecommunications signal in the form of an audio-to-
15 vibrotactile converter signal containing information
about a vibration modulation of the incoming speech from
the called/calling party.

5. A telecommunications network according to claim
4, **characterized in that**

20 the audio-modulated vibrotactile module comprises a
vibrotactile actuator that responds to the audio-to-
vibrotactile converter signal, for providing the audio-
modulated vibrotactile module force in the form of a
vibrotactile actuator force.

6. A telecommunications network according to claim 1, **characterized in that** the audio-to-vibrotactile converter includes a hardware-based signal processor for performing a vibration modulation.

5 7. A telecommunications network according to claim 6, **characterized in that** the vibration modulation includes frequency domain filtering or equalization.

10 8. A telecommunications network according to claim 6, **characterized in that** the vibration modulation includes linear/non-linear amplification.

 9. A telecommunications network according to claim 6, **characterized in that** the vibration modulation includes mixing speech signals with other signals.

15 10. A telecommunications network according to claim 1, **characterized in that** the audio-to-vibrotactile converter includes a software-based signal processor for performing vibration modulation.

20 11. A telecommunications network according to claim 10, **characterized in that** the vibration modulation includes using a speech encoding algorithm.

12. A telecommunications network according to claim 10, **characterized in that** the software-based signal processor responds to user adjustable vibration defining parameters.

5 13. A telecommunications network according to claim 12, **characterized in that** the user adjustable vibration defining parameters include direct numerical parameters.

10 14. A telecommunications network according to claim 12, **characterized in that** the user adjustable vibration defining parameters include a pre-set list of parameters.

 15. A telecommunications network according to claim 1, **characterized in that** the vibrotactile actuator is an electromechanical actuator.

15 16. A telecommunications network according to claim 1, **characterized in that** the vibrotactile actuator is suitably arranged in a housing of the mobile phone for providing vibration on the user's fingers.

17. A telecommunications network according to claim
1, **characterized in that** the vibrotactile actuator is
suitably arranged in a housing of the mobile phone for
providing vibration on the user's facial skin.

5 18. A telecommunications network according to claim
1, **characterized in that** the vibrotactile actuator is
suitably arranged in a housing of the mobile phone for
providing vibration on the user's wrist.

10 19. A telecommunications network according to claim
1, **characterized in that** the vibrotactile actuator is
suitably arranged in a housing of the mobile phone for
providing vibration on the user's cheek.

15 20. A telecommunications network according to claim
1, **characterized in that** the vibrotactile actuator is an
acoustic actuator suitably sized for fitting into a
user's ear.

20 21. A telecommunications network according to claim
3, **characterized in that** the telecommunications network
includes a separately-priced vibrotactile service
network.

22. A telecommunications network according to claim
3, **characterized in that** the audio-to-vibrotactile
converter includes a personalized hearing parameters
module for adjusting speech processing so a user can have
personalized hearing parameters.

23. A telecommunications network according to claim
22, **characterized in that** the personalized hearing
parameters can either be selected by a trial-and-error
basis, preset values or personalized values given by a
user's physician.

24. A telecommunications network according to claim
4, **characterized in that** the telecommunications signal
contains information about the incoming speech that is a
source for vibration modulation.

25. A telecommunications network according to claim
1, **characterized in that** the telecommunications network
uses an F0-format for speech encoding to assist in
interpreting incoming speech in noisy environments.

26. A mobile phone comprising:

an audio-modulated vibrotactile module that responds
to a telecommunications signal containing information
about incoming speech from a called/calling party, for
5 providing an audio-modulated vibrotactile module force
containing information about the incoming speech from the
called/calling party to vibrate a user's fingers, facial
skin, wrist, cheek or other suitable location;

10 the audio-modulated vibrotactile module having an
audio-to-vibrotactile converter that responds to the
telecommunications signal, for providing an audio-to-
vibrotactile converter signal containing information
about a vibration modulation of the incoming speech from
the called/calling party; and

15 the audio-modulated vibrotactile module also having
a vibrotactile actuator that responds to the audio-to-
vibrotactile converter signal, for providing the audio-
modulated vibrotactile module force in the form of a
vibrotactile actuator force.

27. A method comprising the steps of:

converting a telecommunications signal containing
information about incoming speech from a called/calling
party into an audio-to-vibrotactile converter signal
5 containing information about a vibration modulation of
the incoming speech from the called/calling party; and

transforming the audio-to-vibrotactile converter
signal into an audio-modulated vibrotactile module force
containing information about the incoming speech from the
called/calling party to vibrate a user's fingers, facial
10 skin, wrist, cheek or other suitable location.

28. A method according to claim 27, **characterized in**
that the step of converting includes performing vibration
modulation using frequency domain filtering or
15 equalization.

29. A method according to claim 27, **characterized in**
that the step of converting includes performing vibration
modulation using linear/non-linear amplification.

30. A method according to claim 27, **characterized in**
20 **that** the step of converting includes performing vibration
modulation using mixing speech signals with other
signals.

31. A method according to claim 27, **characterized in that** the step of converting includes performing vibration modulation using a speech encoding algorithm.

5 32. A method according to claim 26, **characterized in that** the step of transforming includes electromechanically actuating the audio-modulated vibrotactile module force.

10 33. A method according to claim 26, **characterized in that** the step of transforming includes acoustically actuating the audio-modulated vibrotactile module force.